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**ENVIRONMENTAL ENGAGEMENT: USING THE PHYSICAL
ENVIRONMENT TO SHAPE THE STRATEGIC ENVIRONMENT**

BY

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USAWC STRATEGY RESEARCH PROJECT

**Environmental Engagement:
Using the Physical Environment to Shape the Strategic Environment**

by

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ABSTRACT

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In today's international arena, the U.S. cannot be content to let environmental factors take their own course and then react to the costly crises. The U.S. should actively shape the strategic environment, advancing U.S. national interests, through a coordinated interagency strategy of diplomatic and military environmental engagement.

The linkage between environmental factors and security is now codified as a tenant of United States security policy. Often this linkage is a complex interaction with other political, economic, social and cultural factors which contribute to instability and conflict. Environmental factors will dominate in the complex national security calculus of the next century.

A holistic military and diplomatic shaping strategy is required to reduce the threat of environment induced conflict and exploit opportunities for improved regional stability based on environmental cooperation. This shaping strategy must be the product of synergistic interagency planning, coordination and execution.

The interagency community has made significant progress in initiating this process. However, if these initial efforts are to have a significant impact in advancing U.S. national security interests additional steps must be taken. This study provides specific recommendations for implementation by the National Security Council, Department of State, Department of Defense and the Intelligence Community.

TABLE OF CONTENTS

ABSTRACT	iii
INTRODUCTION	1
THE PHYSICAL ENVIRONMENT AND ENVIRONMENTAL SECURITY	2
PHYSICAL AND STRATEGIC ENVIRONMENTAL LINKS	6
RESOURCE SCARCITY	8
NATURAL AND MAN-MADE DISASTERS	10
NON-DEFENSE ENVIRONMENTAL ENGAGEMENT AND SHAPING	12
DEFENSE ENVIRONMENTAL ENGAGEMENT AND SHAPING	16
RECOMMENDATIONS	24
CONCLUSION	28
ENDNOTES	31
SELECTED BIBLIOGRAPHY	37

Regional or civil conflicts, hastened or exacerbated by environmental stress, could involve the U.S. in costly and hazardous military interventions, peacekeeping or humanitarian operations.¹ - National Security Science and Technology Strategy 1996

Introduction

The end of the bi-polar Cold War era presented the United States with the need and opportunity to revolutionize its security strategy. Recognizing this, then Secretary of Defense Perry called for a new security paradigm in his speech to the John F. Kennedy School of Government on May 13, 1996. In that landmark speech, Secretary Perry emphasized that:

America's security policy in the post-Cold War era requires us to take advantage of that opportunity: to make preventive defense the first line of defense for America, with deterrence the second line of defense, and with military conflict as the last resort.²

Successful preventive defense is evidenced when the United States, through its world-wide engagement activities, shapes the strategic environment to foster conditions which support regional stability and peace, making conflict less likely and deterrence unnecessary.

This shaping strategy rests in part upon the increased recognition of the linkages between environmental factors and regional stability. Often this linkage is a complex interaction with other political, economic, social and cultural factors which contribute to instability and conflict. The National Defense University's 1997 Strategic Assessment identifies environmental scarcity, disasters, and population migrations as

flashpoints which may challenge U.S. national security and require military responses.³

Taking advantage of the synergy of these new concepts, several key agencies of the U.S. Government have begun the process of developing and implementing policies and programs that address environmental factors as issues of strategic significance.

The purpose of this study is to recommend policy options by which the U.S. Government may employ the physical environment as a tool to shape the strategic environment in ways favorable to U.S. national security interests. To achieve this purpose, the study will examine: the impact of the physical environment on security policy, the linkages between the physical environment and the strategic environment, and the environmental programs and resources most suited for shaping the strategic environment.

The Physical Environment and Security Policy

Environmental activism has emerged as a significant national and international political force during the past three decades. The work of popular authors of the 1960s, such as Rachael Carson, Silent Spring, and Paul Ehrlich, The Population Bomb, reflected the growing popular sentiment of a looming environmental crisis. Just as the first Earth Day in 1970 was a watershed event in national environmental activism, the United Nations Conference on the Environment in 1972 was an equally significant event in the mobilization of governments and non-

governmental organizations in international environmental activism.⁴ However, within the mainstream of the security policy community, the environment was at best a marginal issue while primary attention continued to focus on the Soviet threat.

With the end of the cold war, a broadened view of national security which addresses environmental issues began to emerge within the U.S government. In 1991, the Bush administration added environmental issues to the National Security Strategy of the United States.⁵ The Clinton administration has further advanced the environment as a security issue in its National Security Strategy of Enlargement and Engagement and National Security Strategy for a New Century.

Within the academic, government and non-governmental communities, two major perspectives on environmental security with significance to policy-makers have emerged: human security and national security.⁶ The approach that organizations take towards policy and program development, and the types and priority of environmental issues that are addressed are dependent upon this perspective.

The human security perspective emphasizes the need to protect ecological systems to provide for human needs.⁷ Norman Myers, a leading advocate, equates security

to human well-being: not only protection from harm and injury but access to water, food, shelter, health, employment, and other basic requisites that are the due of every person on Earth.⁸

This view is increasingly influential in the policy community and shares a common intellectual foundation with other human security policies such as food and health security.

The national security perspective includes the environment as an increasingly important variable in the complex nature of regional stability and conflict.⁹ This broadened view of national security is reflected in the writings of journalist Robert Kaplan and research of Dr. Thomas Homer-Dixon.

Robert Kaplan's 1994 Atlantic Monthly article, "The Coming Anarchy", paints a compelling picture of the ongoing collapse of society in

much of the underdeveloped world: the withering away of central governments, the rise of tribal and regional domains, the unchecked spread of disease, and the growing pervasiveness of war... It is time to understand the environment for what it is: the national security issue of the early twenty-first century. The political and strategic impact of surging populations, spreading disease, deforestation and soil erosion, water depletion, air pollution, and possibly, rising sea levels in critical, overdeveloped regions...will prompt mass migrations and, in turn incite group conflicts.¹⁰

Kaplan's firsthand accounts are reinforced by academic research. The preeminent analytical study of environmental scarcity and violent conflict in developing countries has been conducted by the Peace and Conflict Studies Program at the University of Toronto under the direction of Dr. Thomas Homer-Dixon. The results of this study have been briefed to senior

policy-makers to include Vice-President Gore. Key findings include:

- Under certain circumstances, scarcities of renewable resources such as cropland, forests and water produce civil conflict and instability.¹¹
- Environmental scarcity can also reduce the ability of states to respond to the needs of their populations.¹²
- Environmental scarcity can contribute to population movements, economic decline and weakened states, which in turn can cause ethnic conflicts, insurgencies and coups d'etat.¹³

This broadened view of the linkage between the physical environment and security, which includes both the human and national security perspectives, is reflected in the current National Security Strategy for a New Century.¹⁴ It calls for an integrated approach to shape the strategic environment to prevent the emergence of threats, respond to the full spectrum of potential crises and prepare today to meet tomorrow's challenges.

This same integrated strategic approach of shaping, responding and preparing is described in both the 1997 National Military Strategy¹⁵ and the Quadrennial Defense Review.¹⁶ The National Military Strategy clearly recognizes the potential environmental risk to U.S. national interests, the consequences of a failure to deal with security threats early, and the vital shaping role for peacetime military engagement:

- Human emergencies other than armed conflict;...and threats to the environment...have the potential to put U.S. interests at risk.¹⁷

- Failure to deal with such security concerns early in their development may require a more substantial response to a more dangerous problem later.¹⁸
- Peacetime military engagement encompasses all military activities involving other nations intended to shape the security environment...and help relieve sources of instability before they can become military crises.¹⁹

Physical and Strategic Environmental Links

Recognizing the principle that an environmental issue may have significant impact on national security is easy.

Determining which issue will impact and its relative priority is a daunting challenge. There is no easy answer to this dilemma, particularly in the interagency and international arena. Each organization approaches the environment from widely differing perspectives (human and national security).

However, Robert Backwill's criteria for analyzing the relationship of external threats to national security interests provide a useful method to prioritize environmental issues. The following three criteria are particularly helpful: the immediacy in time of the threat, the geographic proximity of the threat, and the connectivity of the threat.²⁰

Environmental issues that impact a national interest in close proximity in either time or space will be of great importance. For example, environmental factors prompting increased illegal immigration from Mexico or the Caribbean would be significant. Furthermore, the connectivity, or number of intervening steps between an environmental threat and a

resulting significant impact on a national interest, is a good measure to assist in prioritizing environmental security issues. For example, the number of intervening steps between the deforestation of Haiti and its contribution to internal economic stress, and subsequent illegal immigration to the United States are relatively few and direct. On the other hand, the immediacy, geographic proximity and connectivity of an environmental threat such as global greenhouse gas emissions is much more ambiguous.²¹

Using this approach, the types of environmental issues which are most likely to significantly influence national security are:

- Scarcity or degradation of resources (oil, fresh water, fish, arable land) critical to the political stability or economic well-being of a country or health of the population; and
- Natural (flood, fire, earthquake, hurricane, typhoon) or man-made disasters (oil spill, toxic and hazardous waste disposal, fissile material accident) which threaten the political stability or economic well-being of a country or health of the population.

This does not imply that the U.S. should ignore other less immediate or direct environmental threats, such as climate change, ozone depletion, air and water pollution, and biodiversity loss. Many of these less immediate environmental threats closely relate to the human security perspective and should continue to be pursued through broad global cooperative efforts. Interagency leadership in addressing these threats is most suited to non-DOD agencies. However, DOD may still have an important role in supporting a broad interagency strategy.

Furthermore, prominent DOD engagement in some less immediate international environmental issues may be an effective means to promote diplomatic and military dialogue on a bilateral or multilateral basis to gain regional influence and access.

Resource Scarcity

Nations will go to war to maintain access to scarce resources. Just as oil has been a vital resource scarcity in the late 20th Century, fresh water, fish protein and arable land are the emerging vital resource scarcities for the early 21st Century.

Of these three, fresh water may well be the dominant emerging resource scarcity.²² General Zinni, Commander-in-Chief U.S. Central Command, emphatically states, "There will be future water wars; I guarantee it."²³ The combination of increased agricultural irrigation, industrial production and population growth particularly in urban areas, has increased demand and placed tremendous pressures on fresh water aquifers and rivers. Industrial and agricultural pollution, combined with the lack of adequate sewage and treatment facilities, and the increasing growth of urban populations has significantly affected water quality. Furthermore, polluted water is a major source and transmitter of deadly diseases such as cholera.

Fresh water is the critical resource of the Middle East. Within this region, conflict looms over four water basins: the Tigris-Euphrates River, the Jordan River, the West Bank aquifer

and the Nile River.²⁴ King Hussein of Jordan has remarked, "The only issue over which Jordan might go to war is the issue of water."²⁵

Scarcity of fish stocks in many coastal regions is also a growing concern. This problem is particularly acute for the Pacific Rim states where fish is the most important source of protein in their national diets. Fish stocks are rapidly being depleted by overfishing and marine pollution. All of the world's seventeen major fishing areas are either approaching or have exceeded their sustainable limits.²⁶ As nations compete for dwindling fish stocks, a worldwide trend is accelerating towards the use of force to enforce fishing rights.²⁷

Finally, scarcity of arable land can be a major destabilizing factor. Haiti provides a prime example of how poor land use management can contribute to instability through several complex environmental processes including deforestation, soil erosion and water pollution. Less than two percent of the country remains forested due to unsustainable logging and farming practices. With the loss of tree cover on the country's steep slopes, storms severely eroded the topsoil. Polluted water due to erosion also damaged the near-shore coral reefs and fish stocks.²⁸ The UN estimates that the soil loss is so extensive that 50 percent of the country's land can never be reclaimed for farming. The combination of stripped forests, exhausted subsistence farms, and a rapidly expanding population resulted

in mass migrations to the cities. This intrastate migration, exacerbating urban youth unemployment and violence, was only a transitory phase for those Haitians who would eventually flee the country by boat.²⁹

In addition to resource scarcity and degradation, other aggravating environmental factors such as disease and disasters may endanger regional stability and threaten U.S. security interests. The threat to regional stability due to the spread of disease by viruses, bacteria, and parasites is particularly prevalent in Sub-Sahara Africa. The World Health Organization estimates that by the year 2000, 24 million Sub-Saharan Africans will be infected with HIV (Human Immunodeficiency Virus).³⁰ Additionally, the spread of Ebola-type diseases (90 percent death rate in the last four outbreaks) and drug resistant strains of common diseases (tuberculosis, malaria) pose a particularly serious threat³¹ to government legitimacy and regional stability.

Natural and Man-made Disasters

The legitimacy of a government may also depend upon its ability to effectively respond to natural and man-made disasters. In October 1992, the Egyptian Government (GOE) was slow in responding to the suffering in Cairo's slums following a massive earthquake. The most effective early disaster relief efforts were provided by factions within the country openly opposed to the GOE. The perceived lack of effective action by

the GOE and resulting popular hostility towards it was alleviated when later government efforts began to take effect.³² A more severe natural or man-made disaster combined with a less effective government response could result in the overthrow of a friendly government, such as Egypt, with major strategic significance to U.S. interests.

Direct U.S. international disaster assistance provides opportunities to gain regional influence and access. In 1991 Bangladesh was struck by Cyclone Marian in which over 100,000 people died and millions were left homeless. The newly installed civilian government, after years of military rule, was faced with a daunting challenge in demonstrating its ability to cope with the crisis. The U.S. military Joint Contingency Task Force which responded to the disaster was instrumental in coordinating the international relief effort and aiding the Government of Bangladesh in establishing its legitimacy.³³

The U.S. has increasingly utilized defense resources to perform Military Support to Civil Authority (MSCA) missions in response to domestic disasters (floods, hurricanes, earthquakes, and wildland fires).³⁴ The U.S. military has proven its value in relieving domestic suffering and avoiding the adverse public and political consequences of perceived government inaction and indifference. Similarly, actions by the U.S. to encourage comparable military domestic support capabilities within other

nations serves to promote both government legitimacy and regional stability.

Non-Defense Environmental Engagement and Shaping

The military has also been joined by other key members of the interagency community in applying resources towards environmental security. In particular, the Department of State (DOS), Environmental Protection Agency (EPA), Department of Energy (DOE) and the Intelligence Community have made significant progress in developing environmental initiatives and programs designed to shape the international strategic environment.

The State Department's environmental diplomacy initiative was launched by former Secretary Christopher during an address at Stanford University on April 9, 1996. Secretary Christopher stated,

We must...contend with the vast new danger posed to our national interests by damage to the environment and resulting global and regional instability...³⁵

To implement the environmental diplomacy initiative, the Office of Regional Policy Initiatives was established under the direction of the Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs. On Earth Day 1997, Vice-President Gore and Secretary Albright released the State Department's first annual report, Environmental Diplomacy: The Environment and U.S. Foreign Policy. This report describes

global,³⁶ regional³⁷ and bilateral approaches towards addressing environmental challenges.

In his Stanford speech, former Secretary Christopher also called for the establishment of Environmental Hubs in key embassies throughout the world to address regional natural resource issues.³⁸ These hubs are chartered to integrate environmental issues into regional policies that advance the broader security interests of the United States. The State Department's first annual Environmental Diplomacy report announced the opening of six hubs in 1997 and six more in 1998.³⁹

The Department of Energy is also actively pursuing an environmental security initiative for international engagement. DOE's goals are:

- To establish environmental security as a major element of international program efforts.
- To serve U.S. national interests through cooperative efforts to reverse global environmental degradation. And
- To encourage and assist foreign partners in the establishment of policies and commitments to mitigate and prevent negative environmental conditions.⁴⁰

The Office of Policy and International Affairs coordinates DOE's participation in environmental security activities. This office provides interagency coordination and integration of DOE's capabilities of analysis, research and testing, hazardous and radioactive waste remediation, nuclear safety, and infrastructure development.

The Environmental Protection Agency's Office of International Activities serves a similar interagency coordinating function in executing its international outreach programs. In 1990, recognizing the significance of environmental challenges to the regional development and stability of Eastern Europe after the fall of the Soviet Union, EPA opened a Regional Environmental Center in Budapest, Hungary.⁴¹ EPA also serves as the lead agency coordinating U.S. participation in NATO's environmental security initiative through the Committee on the Challenges of Modern Society (CCMS). This initiative has been undertaken under the broad framework of the North Atlantic Cooperation Council (NACC) and subsequently expanded to include the Partnership for Peace.⁴²

Furthermore, the following recommendations from the 1995 EPA Science Advisory Board report Beyond the Horizon: Using Foresight to Protect the Environmental Future is indicative of the evolving commonality of the DOS, DOD, and DOE environmental security programs:

- As much attention should be given to avoiding future environmental problems as to controlling current ones.⁴³
- ...EPA should establish an early-warning system to identify potential future environmental risks.⁴⁴
- EPA, as well as other agencies and organizations, should recognize that global environmental quality is a matter of strategic national interest.⁴⁵

The Intelligence Community has a long-standing mission of providing environmental intelligence in support of foreign

policy and military operations. John Deutch, former Director of Central Intelligence, emphasized that

adding this environmental dimension to traditional political, economic, and military analysis enhances our ability to alert policy makers to potential instability, conflict, or human disaster and to identify situations which may draw in American involvement.⁴⁶

The Intelligence Community has taken a leading role in the development of an environmental threat assessment and early-warning system as envisioned in the EPA Beyond the Horizon report. Efforts are also proceeding under the Environmental Intelligence Applications Program (EIAP) to further exploit the technical assets of the Intelligence Community to address broader environmental concerns and support the needs of the interagency community.⁴⁷

The DOS, DOE, EPA and the Intelligence Community are only a few of the members of the non-defense interagency community with prominent roles in international environmental engagement. Others include the White House Office of Science and Technology, the Centers for Disease Control and Prevention, the Department of Agriculture's Natural Resource Conservation Service, and the Department of Commerce's National Oceanic and Atmospheric Administration.⁴⁸

These non-defense agencies bring resources and talents to bear which in cooperation with DOD will determine if the military, political and economic forces at work will ultimately

lead to health, prosperity, cooperation and peace, or to disease, poverty, conflict and war.

Defense Environmental Engagement and Shaping

For environmental engagement to effectively shape the strategic environment, interagency planning and coordination between non-defense agencies and DOD must be conducted at both the national and regional levels. The primary agent for national level DOD interagency coordination is the Office of the Deputy Under Secretary of Defense for Environmental Security (ODUSD(ES)), while at the regional level primary responsibility falls to the geographic Commander-in-Chief.

Deputy Under Secretary of Defense (Environmental Security)

ODUSD(ES) was established in May 1993 to provide policy and guidance, oversight and advocacy for the DOD environmental security program. The primary focus of DOD's program is directed towards cleanup, compliance, conservation, pollution prevention and technology development to support DOD's worldwide operation, maintenance, training and basing activities. Its environmental capabilities cover the broad spectrum of military operations from the day-to-day management of installations to the conduct of major theater wars. These capabilities are performed by active duty and reserve units as well as DOD and Military Department (Army, Air Force, Navy, Marine Corps) agencies.

A small, when measured in terms of DOD's national environmental program, but important element of the

environmental security program is its contribution to preventive defense.⁴⁹ The environmental security pillar of preventive defense requires the early identification and response to environmental factors which contribute to instability and conflict, as well as exploiting opportunities for military environmental cooperation to build trust and understanding.⁵⁰

The ODUSD(ES) fulfills a critical leadership role in implementing the environmental security pillar of preventive defense by facilitating interagency environmental coordination, establishing bilateral and multilateral military environmental cooperation agreements, and coordinating the efforts of DOD and Military Departments in support of the geographic Commander-in-Chief's (CINC) environmental shaping strategy.

In July 1996, a key interagency milestone was met when DOD, EPA and DOE signed a memorandum of understanding (MOU) concerning cooperation in environmental security. This MOU established a framework for partnerships between the agencies, foreign governments and industry to jointly address critical environmental concerns.⁵¹ This agreement recognizes that only through collaborative efforts can the agencies pool their unique talents and effectively address the nation's international environmental security challenges. Furthermore, MOU explicitly acknowledges DOS's leadership in conducting foreign policy. However, DOS is not a signatory to the agreement.

An early success of the MOU was the Arctic Region Military Environmental Cooperation (ARMC) agreement which was signed in September 1996 by Secretary Perry; Norwegian Minister of Defense, Jorgen Kosmo; and the Russian Federation Minister of Defense, Igor Rodionov. This agreement initiated a cooperative effort by the three militaries to address several critical environmental issues in the Russian-Nordic region, which include: handling and storage of radioactive materials, disposal of toxic materials and exchange of information on cleanup technologies and methods.⁵²

The ODUSD(ES) has assumed a leading role in the establishment of bilateral and multilateral military environmental cooperation agreements. In concert with NATO and U.S. European Command (EUCOM), the ODUSD(ES) has completed formal bilateral military environmental agreements with the Russian Ministry of Defense, Hungary and Poland and is currently engaged in developing agreements with several other Eastern and Central European countries.⁵³ The most significant progress in developing these agreements has been in the EUCOM area of responsibility where the need exists to address the environmental legacy of the cold war. Other agreements outside of EUCOM are primarily with nations with which the U.S. already has a history of long-standing military cooperation such as Canada and Australia.

Support provided by DOD agencies and the Military Departments has been essential to the success of EUCOM's bilateral outreach to Central and Eastern Europe.⁵⁴ The ODUSD(ES) has a critical role in ensuring that all of DOD's extensive environmental capabilities remain engaged in support of the full range of the geographic CINC's environmental shaping activities. The Environmental Security International Activities Committee provides one important forum for DOD-wide coordination. This committee is chaired by the Principle Assistant to the DUSD(ES) and is attended by representatives from the Military Departments, the Joint Staff, Office of the Under Secretary of Defense (Policy) and the Defense Logistics Agency.⁵⁵

Geographic Commander-in-Chiefs

Regional security is enhanced by each geographic CINC's environmental engagement activities, which increase U.S. access and influence, ameliorate the conditions contributing to instability and conflict, and improve the host nation's capacity to respond to disasters. Environmental engagement activities that advance these objectives are effective shaping events within the CINC's theater engagement strategy. These activities can be executed through a wide-range of existing programs already common to theater engagement plans (military-to-military contacts, combined exercises, nation assistance, security assistance).

Medical, engineer and special operations forces have a prominent role in executing environmental engagement. They may perform environmental engagement activities as small military-to-military contact teams, or as an integrated civil-military operation. EUCOM has been particularly successful in its military-to-military environmental engagement in Eastern and Central Europe through its Joint Contact Team program.⁵⁶

Within the broad scope of civil-military operations, environmental engagement activities may also be important components of Humanitarian and Civic Assistance (HCA) and Military Civic Action (MCA) operations. Typical HCA and MCA environmental engagement activities include medical care, well drilling, and construction or repair of critical public infrastructure such as basic sanitation facilities.⁵⁷

All elements of the CINC's theater engagement plan, to include environmental engagement, require careful coordination and integration with the shaping activities of other U.S. Government agencies, regional and multinational organizations, NGOs and PVOs. Coordination with DOS is particularly important since it is the lead agency in establishing foreign policy and has overall responsibility for synchronizing all international activities.

The Security Assistance (SA) program is one such program which requires close coordination between DOS and DOD. DOS provides oversight, while DOD administers the program. The SA

program is well suited for assisting the militaries of developing nations through environmental engagement. The International Military Education and Training (IMET) and Foreign Military Financing (FMF) components of the SA program can provide the training and equipment necessary to develop environmental prevention and response capabilities within foreign militaries similar to those which currently exist within the U.S. military. Environmental military capabilities can be an important national resource for developing countries, particularly when the military is providing environmental support to civil authorities.

The non-lethal nature of environmental SA can also provide additional options for maintaining U.S. influence and access when the supply of other more traditional SA equipment or training is not appropriate. For example, the purchase of nine F-16 fighters by Indonesia was canceled in 1997 due to Congressional human rights concerns.⁵⁸ Just a few months later the U.S. deployed specially equipped National Guard C-130s to Indonesia to conduct aerial firefighting.⁵⁹ The inclusion of firefighting C-130s in the SA program would advance U.S. interests by maintaining regional access and influence, while both nations would benefit from the increased regional aerial firefighting capability.

The SA program has been used to encourage African military forces to promote biodiversity, natural resource conservation,

and environmental management.⁶⁰ Two programs of particular applicability to environmental engagement are the African Coastal Security (ACS) and the Biodiversity programs. The ACS program assisted sixteen West African countries to enhance the ability of their coastal navies to protect their fish resources from the predatory practices of foreign fishing fleets.⁶¹ The Biodiversity program provided equipment and technical assistance to protect wildlife habitats and endangered species, and support anti-poaching efforts. However, neither of these programs are currently funded.⁶²

Even though the DOS has overall responsibility for foreign policy, the geographic CINCs possess unique regional perspectives and capabilities for policy development, coordination and execution. The CINC's theater engagement plan consists of a series of bilateral and multilateral activities, however they are founded upon an overarching regional strategy. On the other hand, the Ambassadors within the region are more narrowly focused on U.S. relations with their country of assignment. The CINC also has the benefit of a supporting staff with a strategic planning capability and experience in disciplined program execution. Additionally, the CINC has the credibility of being the regional representative of the world's most powerful military and the ability to draw upon the resources of the DOD to address regional challenges and exploit opportunities.

All of these factors combine to emphasize the importance of the CINC's theater engagement strategy in shaping the regional strategic environment and advancing U.S. interests. Environmental engagement can be a valuable shaping tool within this strategy.

In countries where the CINC already has significant military-to-military contact, environmental engagement activities can provide a new forum for expanded cooperation. In countries, where the CINC has little or no effective contact, the environment may provide a forum for initial cooperation which can be nurtured and broadened. This may well be the most effective form of engagement in situations where more traditional forms of military-to-military contact may not be currently feasible due to political considerations, especially if environmental factors threaten vital or important interests of the host-nation government.

Environmental engagement activities can enhance the capabilities of potential coalition partners to provide assistance in response to regional contingencies and emergencies. These capabilities could reduce dependence on the U.S. to provide forces and resources for crisis response. In cases where other nations are either unwilling or unable to provide direct assistance, the increased access and influence achieved through engagement may result in the granting of basing or overflight rights. These rights are critical to the execution

of regional contingencies throughout the full spectrum of operations.

A holistic military and diplomatic environmental shaping strategy which reduces the threat of environment induced conflict and exploits opportunities for improved regional stability based on environmental cooperation, must be a product of synergistic interagency planning, coordination and execution.

Recommendations

The interagency community has made significant progress in initiating the process of employing the physical environment to shape the strategic environment. In particular DOS, DOD, EPA, DOE and the Intelligence Community have established much of the preliminary policy, organizational and programmatic framework upon which an effective integrated strategy of environmental shaping depends. However, if these initial efforts are to have a significant impact on advancing U.S. national security interests, additional steps should be taken to achieve synergistic improvements in the planning, programming and execution of environmental shaping activities. The following recommendations are set forth to this end:

- **The National Security Advisor should appoint a special assistant for international environmental security affairs.**

This special assistant would chair an interagency working group chartered to develop a Presidential Decision Directive (PDD) establishing a U.S. international environmental

security policy.⁶³ This policy must go beyond the recognition that international environmental factors can adversely affect regional stability. It should clearly articulate a policy of proactive international environmental shaping activities which promote regional stability and advance U.S. national security interests. Additional tasks for the interagency working group include: coordinate planning, programming and execution of international environmental engagement; identify critical international environmental shaping activities for inclusion in the National Security Strategy; and support the Administration in articulating the benefits of international environmental engagement to both the Congress and the public.

- **The Department of State should take an active role at both the national and regional level to coordinate international environmental shaping activities.** DOS's responsibility and authority for coordinating international environmental engagement as well as the supporting roles for other agencies must be codified in the PDD. However, even without this PDD in-place, DOS should take immediate steps to provide a central focus for environmental shaping activities. National level coordination would be advanced by DOS sponsorship of an expanded interagency MOU based on the existing DOD, EPA and DOE MOU. Improved regional coordination would be advanced by DOS sponsorship of interagency fora for each Environmental

Hub. The DOS regional bureaus must take a leading role in advancing the regional interagency process.

- **The Intelligence Community should accelerate its interagency effort to develop an environmental threat assessment and early-warning system.** DOS and DOD should place a high priority on fielding of an environmental threat assessment and early-warning system that serves its diplomatic and military end-users (Ambassadors and geographic CINCs). National collection and analysis assets must provide the intelligence to support the difficult resource constrained policy and programming decisions inherent in the execution of the environmental dimensions of preventive diplomacy and defense.
- **The National Military Strategy should explicitly identify a proactive shaping role for military environmental engagement activities to promote peace and regional stability.** These activities assist nations in their own efforts to combat destabilizing environmental factors and to improve their internal capacity to respond to national and regional crises. Furthermore, environmental engagement provides U.S. access and influence through both diplomatic and military channels with nations which are either potential coalition partners or control critical basing and overflight rights. Environmental engagement should be fully integrated with the full range of

shaping activities in the geographic CINC's theater engagement plan. In this way, environmental engagement can be an important link in shaping the peacetime strategic environment to permit a successful transition to regional crisis response.

- The ODUSD(ES) should cooperate with the geographic CINCs and interagency community to accelerate the process of establishing bilateral and multilateral military environmental cooperation agreements. These agreements form the basis for defining shared environmental challenges and opportunities for military cooperation. Priority should be placed on establishing agreements with key regional powers (India, China, Brazil, et al), lesser regional powers where access (basing and overflight) is critical to the execution of regional contingencies, and developing nations where environmental induced state and regional instability is likely to result in military or humanitarian crises.
- Funding for environmental engagement should emphasize activities which enhance the capacity of foreign countries to prevent and respond to both national and regional environmental threats. International capacity building will reduce the need for long-term dependence on limited U.S. resources as well as decrease the potential for near-term major civil-military humanitarian operations (ex., Somalia,

Rwanda). Furthermore, funding priorities for environmental preventive diplomacy and defense activities should be evaluated based upon the immediacy in time, geographic proximity and connectivity of the environmental threat to U.S. security interests.

- **Avoid the establishment of new environmental engagement programs if an existing program can be modified or expanded to achieve the desired objective.** For example, the Security Assistance (SA) program provides equipment and training to develop host-nation military capabilities. DOD and DOS should expand opportunities for environmental engagement through this program. In developing countries, host-nation Military Support to Civil Authorities (MSCA) activities can significantly contribute to securing their vital national interests (stability, sustainable development). Environmental SA program enhancements to host-nation MSCA capabilities include the following mission areas: environmental infrastructure development, natural resource conservation, environmental management, public safety and health, and natural and man-made disaster response.

Conclusion

It is difficult to predict exactly how the physical environment will influence the strategic environment of the 21st Century. The only thing that can be said with certainty is that

environmental factors will dominate in the complex national security calculus of the 21st Century.

In today's international arena, the U.S. cannot be content to let environmental factors take their own course and then react to the costly crises. The U.S. should actively shape the strategic environment, advancing U.S. national interests, through a coordinated interagency strategy of diplomatic and military environmental engagement. The benefits are immediate and significant; the costs are small.

(5668 words)

ENDNOTES

¹The White House Office of Science and Technology Policy, National Security Science and Technology Council, National Security Science and Technology Strategy, 1996; available from <<http://www.whitehouse.gov/WH/EOP/OSTP/nssts/html/nssts.html>>; Internet; accessed 10 July 1997.

²William J. Perry, remarks, John F. Kennedy School of Government, Harvard University, 13 May 1996; available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html#taba>>; Internet; accessed 22 November 1996.

³Institute for National Security Studies, "Flashpoints," Strategic Assessment 1997: Flashpoints and Force Structure, 1997; available from <<http://www.ndu.edu/ndu/inss/sa97/sa97chl.html>>; Internet; accessed 30 December 1997.

⁴Richard A. Matthew, "Environmental Security: Demystifying the Concept, Clarifying the Stakes," Wilson Report: Environmental Change and Security Project 1 (Spring 1995): 15.

⁵The White House, National Security Strategy of the United States (Washington, D.C.: U.S. Government Printing Office, 1991), 22.

⁶Richard A. Matthew, "Environment and Security: Definitions and Concepts," in Conference Report: Environmental Change and Regional Stability, ed. Kent H. Butts (Asia-Pacific Center for Security Studies and U.S. Army War College Center for Strategic Leadership: 1997), III-11.

⁷Ibid.

⁸Norman Myers, Ultimate Security: The Environmental Basis of Political Stability (New York: W. W. Norton, 1993), 31.

⁹Richard A. Matthew, "Environment and Security: Definitions and Concepts," III-12.

¹⁰Robert Kaplan, "The Coming Anarchy," February 1994; available from <<http://www.theatlantic.com/election/connection/foreign/anarchy.html>>; Internet; accessed 31 October 1997.

¹¹Thomas Homer-Dixon, "The Project on Environment, Population and Security: Key Findings of Research," Wilson Report: Environmental Change and Security Project 2 (Spring 1996): 45.

¹²Ibid.

¹³Ibid., 48.

¹⁴The White House, A National Security Strategy for a New Century (Washington, D.C.: U.S. Government Printing Office, 1997), 6. The National Security Strategy articulates a role for the physical environment in support of each of the strategy's three core objectives: enhancing security, promoting prosperity and promoting democracy. However, the environment is most influential in enhancing security and promoting prosperity. Within the realm of enhancing security, environmental damage is identified as a transnational threat in the same category as terrorism, illegal drug trade, illicit arms trafficking, international organized crime and uncontrolled refugee migrations. The environmental contributions to promoting prosperity address the continued need for unrestricted U.S. access to foreign oil resources. Oil is identified as the most significant resource scarcity which directly threatens the U.S., and ensuring access to this critical resource is a vital interest. Furthermore, environmental and natural resource issues are key considerations in promoting sustainable development abroad.

¹⁵John M. Shalikashvili, National Military Strategy 1997: Shape, Respond, Prepare Now - A Military Strategy for a New Era (Washington, D.C.: Joint Chiefs of Staff, 1997), 5.

¹⁶Department of Defense, Report of the Quadrennial Defense Review (Washington, D.C.: U.S. Government Printing Office, 1997), iv.

¹⁷Shalikashvili, 3.

¹⁸Ibid., 4.

¹⁹Ibid., 2.

²⁰Robert D. Blackwill, "A Taxonomy for Defining US National Security Interests in the 1990s and Beyond," in Europe in Global Change, ed. Verner Veidenfeld and Josef Janning (Gutersloh, Germany: Bertelsmann, 1993), 105.

²¹Ibid., 109.

²²Kent H. Butts, "The Strategic Significance of Water," Parameters 27 (Spring 1997), 66.

²³Sherri Goodman, remarks, Second Annual Strategic Conference of the Institute of International Strategic Relations, 13 May 1997; available from <http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-30.html>; Internet; accessed 15 December 1997.

²⁴Butts, 75-77.

²⁵Bud Vazquez, "Environmental Hotspots: Faceless Enemies Spawn Unique Challenges for Military Planners," Armed Forces Journal International (August 1997): 44.

²⁶Institute for National Security Studies, "Environment," Strategic Assessment 1997: Flashpoints and Force Structure, 1997; available from <http://www.ndu.edu/ndu/inss/sa97/sa97ch18.html>; Internet; accessed 30 December 1997.

²⁷Mark Rosen, "Fishing Disputes Involving the U.S. and Canada," information paper for Chairman Joint Chiefs of Staff, Washington D.C., 28 March 1995.

²⁸Institute for National Security Studies, "Environment."

²⁹Thomas Homer-Dixon and Valerie Percival, Environmental Scarcity and Violent Conflict: Briefing Book (Toronto: University of Toronto, 1994), 47.

³⁰C. William Fox, Jr., "Phantom Warriors: Disease as a Threat to US National Security," Parameters 27 (Winter 1997-98): 127.

³¹Ibid., 126.

³²Kaplan.

³³Chairman, Joint Chiefs of Staff, Joint Doctrine for Military Operations Other Than War, Joint Publication 3-07 (Washington, D.C.: U.S. Government Printing Office, 1995), III-6.

³⁴David Grange and Rodney Johnson, "Forgotten Mission: Military Support to the Nation," Joint Force Quarterly (Spring 1997): 110.

³⁵Warren Christopher, "American Diplomacy and the Global Environmental Challenges of the 21st Century," 9 April 1996; available from <http://www.state.gov/www/global/oes/speech.html>; Internet; accessed 15 July 1997.

³⁶Department of State, Environmental Diplomacy: The Environment and U.S. Foreign Policy (Washington, D.C.: U.S. Government Printing Office, 1997), 5. This report identifies five global environmental priorities: climate change, toxic chemicals and pesticides, biological diversity, deforestation, and marine degradation.

³⁷Ibid., 19. This report identifies five regional environmental priorities: water resources, air quality, energy resources, land use and urban and industrial growth.

³⁸Christopher.

³⁹Department of State, 30-31. The first six hubs are the Central American and Caribbean hub in San Jose, Costa Rica; the Central Asian hub in Tashkent, Uzbekistan; the Eastern African hub in Addis Ababa, Ethiopia; the South Asian hub in Katmandu, Nepal; the Middle East hub in Amman, Jordan; and the Southeast Asian hub in Bangkok, Thailand.

⁴⁰Abraham Haspel, "Department of Energy Perspective on Environment and Security," available from <<http://w3.pnl.gov:2080/ces/policy/haspel.htm>>; Internet; accessed 29 December 1997.

⁴¹Office of International Activities, "New Regional Environmental Center for the NIS," available from <<http://www.epa.gov/oiamount/fact.htm>>; Internet; accessed 29 December 1997.

⁴²Office of International Activities, "An Overview of the Committee on the Challenges of Modern Society (CCMS)," available from <<http://www.epa.gov/oiamount/nato.htm>>; Internet; accessed 29 December 1997.

⁴³Science Advisory Board, Environmental Futures Committee, Beyond the Horizon: Using Foresight to Protect the Environmental Future (Washington, D.C.: U.S. Environmental Protection Agency, 1995), 21.

⁴⁴Ibid., 22.

⁴⁵Ibid., 29.

⁴⁶Sherri Goodman, remarks, National Defense University, "The Environmental and National Security," 8 August 1996; available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html>>; Internet; accessed 15 December 1997.

⁴⁷"The Intelligence Community," Wilson Report: Environmental Change and Security Project 3 (Spring 1997): 211.

⁴⁸"Governmental Activities," Wilson Report: Environmental Change and Security Project 3 (Spring 1997): 206-213.

⁴⁹Sherri Goodman, remarks, Honolulu, HI, Third Annual Pacific Rim Environmental Conference, 7 September 1994; available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-05.html>>; Internet; accessed 15 December 1997.

⁵⁰Sherri Goodman, remarks, National Foreign Affairs Training Center, "Environmental Issues, Natural Resources and U.S. National Interests," 10 September 1996; available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-23.html>>; Internet; accessed 15 December 1997.

⁵¹"Memorandum of Understanding Among the Environmental Protection Agency, the Department of Energy, and the Department of Defense Concerning Cooperation in Environmental Security," 3 July 1996; available from <<http://denix.cerem.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html>>; Internet; accessed 22 December 1997.

⁵²Department of Defense, "Arctic Region Military Environmental Agreement Signed," U.S. Department of Defense news release no. 556-96, September 1996.

⁵³Gary Vest, "DOD International Environmental Activities," Federal Facilities Environmental Journal (Spring 1997): 13.

⁵⁴Ibid.

⁵⁵Sherri Goodman, remarks, Honolulu, HI, Third Annual Pacific Rim Environmental Conference.

⁵⁶John Faunce, "U.S. European Command Environmental Program," briefing, Headquarters U.S. European Command, 20 August 1996.

⁵⁷Chariman, Joint Chiefs of Staff, III-10.

⁵⁸Congress, Senate, Office of Senator Feingold, "Congressional Pressure Results in Dropping of U.S. Arms Sales to Indonesia," press release, 6 June 1996.

⁵⁹Department of Defense, "Air National Guard Members and C-130s to Return from Indonesia Fire Fighting Mission," U.S. Department of Defense news release no. 651-973, December 1997.

⁶⁰Kent H. Butts, Environmental Security: What is DOD's Role? (U.S. Army War College Strategic Studies Institute, 1993), 9.

⁶¹Joanne Bernstein, "Military Assistance in Sub-Saharan Africa," DISAM Journal of International Security Assistance Management 17 (Fall 1994): 96-97.

⁶²Institute for National Security Studies, Strategic Assessment 1995: U.S. Security Challenges in Transition (Washington, D.C.: National Defense University Press, 1995), 106.

⁶³Kent H. Butts, Environmental Security: A DOD Partnership for Peace (U.S. Army War College Strategic Studies Institute, 1994), 36.

SELECTED BIBLIOGRAPHY

Bernstein, Joanne. "Military Assistance in Sub-Saharan Africa." DISAM Journal of International Security Assistance Management 17 (Fall 1994): 90-103.

Blackwill, Robert D. "A Taxonomy for Defining US National Security Interests in the 1990s and Beyond." in Europe in Global Change. ed. Verner Veidenfeld and Josef Janning. Gutersloh, Germany: Berpelsnenn, 1993.

Butts, Kent H. Environmental Security: A DOD Partnership for Peace. U.S. Army War College Strategic Studies Institute, 1994.

_____. Environmental Security: What is DOD's Role? U.S. Army War College Strategic Studies Institute, 1993.

_____. "The Strategic Significance of Water." Parameters 27 (Spring 1997): 65-83.

Chairman, Joint Chiefs of Staff. Joint Publication 3-07. Joint Doctrine for Military Operations Other Than War. Washington, D.C.: U.S. Government Printing Office, 1995.

Christopher, Warren. "American Diplomacy and the Global Environmental Challenges of the 21st Century." 9 April 1996. Available from <<http://www.state.gov/www/global/oes/speech.html>>. Internet. Accessed 15 July 1997.

Faunce, John. "U.S. European Command Environmental Program." Briefing. Headquarters U.S. European Command. 20 August 1996.

Fox, C. William. "Phantom Warriors: Disease as a Threat to US National Security." Parameters 27 (Winter 1997-98): 121-136.

Goodman, Sherri. Remarks. Honolulu, HI. Third Annual Pacific Rim Environmental Conference. 7 September 1994. Available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-05.html>>. Internet. Accessed 15 December 1997.

_____. Remarks. National Defense University. "The Environmental and National Security." 8 August 1996. Available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html>>. Internet. Accessed 15 December 1997.

- _____. Remarks. National Foreign Affairs Training Center. "Environmental Issues, Natural Resources and U.S. National Interests." 10 September 1996. Available from <<http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-23.html>>. Internet. Accessed 15 December 1997.
- _____. Remarks. Second Annual Strategic Conference of the Institute of International Strategic Relations. 13 May 1997. Available from <http://denix.cecer.army.mil/denix/Public/ES-Programs/Speeches/Speech-30.html>>. Internet. Accessed 15 December 1997.
- "Governmental Activities." Wilson Report: Environmental Change and Security Project 3 (Spring 1997): 206-213.
- Grange, David and Rodney Johnson. "Forgotten Mission: Military Support to the Nation." Joint Force Quarterly (Spring 1997): 108-115.
- Haspel, Abraham. "Department of Energy Perspective on Environment and Security." Available from <<http://w3.pnl.gov:2080/ces/policy/haspel.htm>>. Internet. Accessed 29 December 1997.
- Homer-Dixon, Thomas. "The Project on Environment, Population and Security: Key Findings of Research." Wilson Report: Environmental Change and Security Project 2 (Spring 1996): 45-48.
- Homer-Dixon, Thomas and Valerie Percival. Environmental Scarcity and Violent Conflict: Briefing Book. (Toronto: University of Toronto), 1994.
- Institute for National Security Studies. Strategic Assessment 1995: U.S. Security Challenges in Transition. Washington, D.C.: National Defense University Press, 1995.
- _____. Strategic Assessment 1997: Flashpoints and Force Structure. 1997. Available from <<http://www.ndu.edu/ndu/inss/sa97/sa97.html>>. Internet. Accessed 30 December 1997.
- Kaplan, Robert. "The Coming Anarchy." February 1994. Available from <<http://www.theatlantic.com/election/connection/foreign/anarchy.html>>. Internet. Accessed 31 October 1997.
- Matthew, Richard A. "Environment and Security: Definitions and Concepts." In Conference Report: Environmental Change and Regional Stability, ed. Kent H. Butts, III-7 - III-26. Asia-Pacific Center for Security Studies and U.S. Army War College Center for Strategic Leadership, 1997.

_____. "Environmental Security: Demystifying the Concept, Clarifying the Stakes." Wilson Report: Environmental Change and Security Project 1 (Spring 1995): 14-23.

"Memorandum of Understanding Among the Environmental Protection Agency, the Department of Energy, and the Department of Defense Concerning Cooperation in Environmental Security." 3 July 1996. Available from <<http://denix.cerem.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html>>. Internet. Accessed 22 December 1997.

Myers, Norman. Ultimate Security: The Environmental Basis of Political Stability. New York: W. W. Norton, 1993.

Office of International Activities. "New Regional Environmental Center for the NIS." Available from <<http://www.epa.gov/oiamount/fact.htm>>. Internet. Accessed 29 December 1997.

_____. "An Overview of the Committee on the Challenges of Modern Society (CCMS)." Available from <<http://www.epa.gov/oiamount/nato.htm>>. Internet. Accessed 29 December 1997.

Perry, William J. Remarks. John F. Kennedy School of Government, Harvard University. 13 May 1996. Available from <<http://denix.cerem.army.mil/denix/Public/ES-Programs/Speeches/Speech-22.html#taba>>. Internet. Accessed 22 November 1996.

Rosen, Mark. "Fishing Disputes Involving the U.S. and Canada." Information paper for Chairman Joint Chiefs of Staff. Washington D.C., 28 March 1995.

Science Advisory Board, Environmental Futures Committee. Beyond the Horizon: Using Foresight to Protect the Environmental Future. Washington, D.C.: U.S. Environmental Protection Agency, 1995.

Shalikashvili, John M. National Military Strategy 1997: Shape, Respond, Prepare Now - A Military Strategy for a New Era. Washington, D.C.: Joint Chiefs of Staff, 1997.

U.S. Congress. Senate. Office of Senator Feingold, "Congressional Pressure Results in Dropping of U.S. Arms Sales to Indonesia." Press release, 6 June 1996.

U.S. Department of Defense. "Air National Guard Members and C-130s to Return from Indonesia Fire Fighting Mission." U.S. Department of Defense News Release no. 651-973, December 1997.

- _____. "Arctic Region Military Environmental Agreement Signed." U.S. Department of Defense News Release no. 556-96, September 1996.
- _____. Report of the Quadrennial Defense Review. Washington, D.C.: U.S. Government Printing Office. 1997.
- U.S. Department of State. Environmental Diplomacy: The Environment and U.S. Foreign Policy. Washington, D.C.: U.S. Government Printing Office, 1997.
- Vazquez, Bud. "Environmental Hotspots: Faceless Enemies Spawn Unique Challenges for Military Planners." Armed Forces Journal International (August 1997): 44.
- Vest, Gary. "DOD International Environmental Activities." Federal Facilities Environmental Journal (Spring 1997), 7-18.
- The White House. A National Security Strategy for a New Century. Washington, D.C.: U.S. Government Printing Office, 1997.
- _____. National Security Strategy of the United States. Washington, D.C.: U.S. Government Printing Office, 1991.
- The White House Office of Science and Technology Policy, National Security Science and Technology Council. National Security Science and Technology Strategy. 1996. Available from <<http://www.whitehouse.gov/WH/EOP/OSTP/nssts/html/nssts.html>>. Internet. Accessed 10 July 1997.